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ABSTRACT

An experiment in teaching logic to fifth graders using a children's story is reported. Part one of the report develops the experiment's rationale. A lack of reasoning ability among children is perceived and several causes are suggested -- among them a reliance on reading, math, and science as vehicles for reasoning, emphasis on problem solving rather than the preliminaries of questioning, and complacency regarding the development of reasoning because of the "inevitability" of development implied by Piagetian research. To allow children to perceive themselves capable of reasoning, instruction in reasoning for fifth graders is proposed. Instruction combining a discovery model and a context of "important" ideas is suggested. Part two of the report describes the experiment. A pilot group of 10-year-olds, taught twice a week for nine weeks using the story, "Harry Stottlemeier's Discovery," (SO 008 127), is tested against a control group. Instruction consists of reading, discussion, some role playing, and use of a video tape machine. Posttesting shows an advance by the pilot group over the control group in logical thinking and in mental maturity. A second study testing the same two groups indicates a significantly positive effect on the reading scores of the pilot group over the control group 2 1/2 years later, suggesting the long lasting effect of the teaching of logic and the need to replicate the experiment. (JH)

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PHILOSOPHY FOR CHILDREN

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Sometime in 1968 it occurred to me that we might do a better job of teaching children to reason than we were already doing. I had very little knowledge of the sort of research that had already been done in this area, and the whole conception of what was involved in "teaching reasoning" was quite unclear to me. Was teaching the rules of inference teaching reasoning? Was teaching children to recognize and perform certain inferential patterns teaching reasoning? Could reasoning actually be taught at all--or could we at best merely sensitize children to distinguish certain forms of inference as awkward or sloppy, much as we sensitize them to recognize "bad grammar" without actually teaching them grammar?

I recall writing to Monroe Beardsley about the possibility of doing something about the problem at that time, and I believe I also discussed it then with Justus Buchler. Both were encouraging.

But I didn't want to teach children logic in the way we taught (or pretended to teach) college students logic. The children would certainly object to having one more nauseating subject crammed down their throats--and they'd have been right. Someone suggested to me that I somehow present logic in the form of a children's story. The possibility intrigued me: a story told almost as a child would relate it of the discovery by a group of children of how their own thought processes work, and how more effective thought processes could be distinguished from less effective ones.

In 1969, I applied to the National Endowment for the Humanities for a pilot project grant. I proposed to write the children's book and to teach it in a true field experiment. The grant was approved, and I wrote the book and carried out the project in the 1970-71 academic year. The teaching was done at the Rand School, Montclair, New Jersey.

The Endowment then gave me a two year grant, covering 1971-73, for amplification of the project, under the auspices of the Department of Philosophy,

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Columbia University. During this period I developed a teacher's manual, arranged for the preparation of a children's workbook, and made it possible for several teachers of grades 5-8 to try working with the children's materials. I also wrote a story for highschool students, in the form of a novel.

Part One of the following paper was written in 1970, at the time the pilot project was being organized. It sets forth the rationale of the project, and the hopes I then had for it.

Part Two is an account of the pilot project itself.

PART ONE

The remarks that follow have been set forth with a twofold purpose: (1) to provide both an introduction and a rationale for an experiment dealing with reasoning in children, and (2) to show the ramified implications of the experiment for the process of education generally.

1. Why Johnny can't reason

American education has been indicted often and eloquently. Some of the charges are correct, some are not. In many cases the critics may be found to share common assumptions with the educational system they seek to criticize. For example, critics are often found complaining that children reason poorly because reading and mathematics are badly taught, and the schools respond by frantically searching for ways to teach these subjects better. It seldom seems to occur to either party that, while reading and mathematics are disciplines that contribute usefully to good thinking, they cannot suffice to produce it. The fact that Johnny adds, subtracts, multiplies, divides, and can race through a Danny Dunn book doesn't mean he can reason. It doesn't mean he is developing habits of efficient thinking or of arriving at independent judgments. Something more is needed.

Perhaps the above statement is too drastic. It's not that Johnny can't reason. It's just that he can't reason as well as he should. And it's doubtful that the present educational system can take much credit for the reasoning he does perform. No one ever seems to bother to instruct the child in the hygiene of thinking. It's just something he picks up by himself, or something he quietly and unconsciously absorbs through the pores of his skin. (On the rare occasions in which he is taught "critical reading," it seems to be done quite unsystematically).

Alongside the lack of attention given to reasoning in today's curriculum is the equally deplorable trivialization of content. The moment we consider discussing a matter of some importance with the child, a thousand scruples emerge to inhibit us. The spectre of an outraged PTA is invoked; the casual manner disappears, and we become once again models of didactic pendantry. Those who recognize the banality and stodginess of much of the current content often seek to correct it, not by substituting materials that would be of genuine importance to the child, but by sensationalizing the trivial so as to compel the child's interest in what remains fundamentally inane. Obviously, instead of the lurid presentation of banalities, we need to develop attractive modes of presenting matters of intellectual substance without compromising the integrity of that substance. The objective here is not to confront the child with two isolated entities, the structure of logical thought on the one hand, and a mass of baffling profundities on the other, but to allow the child to discover how thought can play upon its subject-matter, how reasoning about issues of importance can be satisfying even if it does no more than formulate the basic questions.

But what does the school system do to stimulate the child's reasoning capacities?

He receives training in mathematics. It would be of course absurd to deny that mathematics involves reasoning. But it is reasoning that is so

highly abstract, so incredibly sui generis, that it has yet to be demonstrated satisfactorily that the capacity for mathematical deduction is transferrable in any significant way to conceptual deduction. Hardly a semester goes by that a teacher fails to discover students who are excellent in mathematics but deplorable in English, or vice versa. Apparently the referential and connotative aspects of language, its richness of meaning, its nearness to everyday actuality, are precisely what frighten off certain students who prefer only the manipulation of pure symbols. It would appear that educators have been greatly oversold on the power of mathematical training to improve children's abilities to draw logical inferences from what they have heard or read, or to make appropriate logical distinctions.

Secondly, the child is given courses in science, and a certain portion of such courses is often devoted to "inference". But the inference referred to is not the relatively rigorous deductive inference. It is instead the much more suppositious process known as "inductive inference". It may be granted that one type of induction--generalization--is a fairly rudimentary intellectual operation. But another type, the forming of hypotheses, is a process of extreme subtlety. It is far closer to art than to mere craft. Just as we really cannot teach anyone how to invent new and worthwhile sculptural or painterly or musical compositions (although we can create an environment which is more conducive to inventive and more hostile to non-inventive behavior than are most environments), so it is unlikely that we can teach children or adults how to invent worthwhile hypotheses. There is no known method for producing new ideas. But the point is that it is unreasonable to believe complacently that we are teaching children all they need to know about inference just because we teach them to draw probable inferences from their perceptions. (One recalls that often, when Sherlock Holmes would come out with one of his hypotheses, Watson would compliment him on his magnificent deduction! But whether the difficulty lay with Watson or with Conan Doyle is rather difficult to say).

Thirdly, the young student is taught to "read for meaning", or at least such teaching is attempted. At first glance, it might seem that "reading for meaning" does involve precisely those logical mechanisms on which deductive inference and our verbal judgments depend. Unfortunately, this is only partially correct. For if the inferences involved in mathematics are generally too abstract to be transferred efficiently to verbal thought, the contrary is often true with literary inference; it is too concrete to permit such transfer.

No doubt each work of literature has a "logic" of its own. But it is not (thank heavens!) the deductive logic of formal thought. And what is true of literature is true to a lesser degree of all expositor writing. Verbal meanings depend upon connotation and suggestion, upon all sorts of nuances other than what can logically be deduced from a given set of statements in a given context. What one teacher will call "the" meaning of a given literary passage, another may dismiss as "far-fetched interpretation". A good case in point would be the enigmatic directions to the exercises in almost any of today's children's textbooks. They frequently seem to be masterpieces of befuddlement. Many children still manage to perform the exercises correctly, but this is in spite of the directions rather than because of them.

In other words, we expect the pupil to find clear and unambiguous meanings in contexts which are rich in indirection and allusiveness. That children frequently develop a knack of telling us what they suspect we want to hear should not delude us into thinking we have improved their powers of deduction regarding the written materials in question.

Fourthly, there is the attention given in some schools to the process of "problem-solving". But in order to solve problems, a stage of formulation is needed, and prior to formulation, it is necessary that crucially relevant questions be raised. The doubts that are symptomatic of the problems themselves should be utilized in this stage of question-raising. I can recall the dean of a large medical school remarking that today's medical students wish

to rush immediately into prognosis and treatment; they have little time for careful diagnosis. But this is an attitude we have encouraged with our stress upon "problem-solving", without an equal stress upon the need for independent thinking, careful attention to one's doubts, importance of question-raising, and other such significant aspects and phases of the preliminaries of inquiry.

Quite possibly, the complacency we exhibit regarding the development of reasoning in children has been increased rather than diminished by our increasing familiarity with the work of Piaget. The inevitability of logical development which Piaget seems to imply in his descriptive (but rarely pedagogical) studies tends to lull many readers into believing that it is not necessary to push the child up the inclined plane of improved reasoning in the way we acknowledge we must push him in other disciplines.

According to Piaget, children begin to function logically even before they acquire language. It is evident that their reasoning capacities remain rather rudimentary in the earlier phases of their development. Until they are 11 or 12, Piaget believes, they remain wrapped up in the more concrete aspects of experience; perception, sensation, imagination and insight are prevalent, but abstract thought is rare. Then suddenly they take off, and in a year or so they reach a new and rarified plateau, where they perceive and manipulate abstract relationships, and even understand that they are doing so.

Apparently, all that Piaget can suggest to educators is that they tailor the child's education to conform to the phases of his logical development. Yet, as I shall contend later in more detail, even this meager advice is either erroneous or subject to erroneous interpretation. It does not allow for acceleration of education in thinking. And it suggest that because the child thinks concretely in a certain sense in his early years, that his instruction during this period should likewise be concrete. Methodologically this is highly questionable.

2. The Child and the Educational Establishment

The intellectual possibilities of the American school child remain largely unrecognized and unexplored. We teach him to think about various subjects--English, history, social studies, and so on. But we do not teach him to think about thinking, although he is capable of doing so and would be interested in doing so. We do not sufficiently encourage him to think for himself, to form independent judgments, to be proud of his personal insights, to be pleased with his prowess in reasoning. Reacting against our Puritan heritage once again, the fashion is now to encourage the child to feel, to be sensitive--having first armored him against feelings and anesthetized him against sensations. But we do not trust him to think.

Outside the school, things are no better. Although television is everybody's whipping boy, it is doubtful that the often chaotic patterns of stimuli it offers are more destructive than the bland physicality of Boy's Life or the cynicism and nihilism of Mad magazine. Television treats the child as a potential consumer; the children's magazines treat the boys as potential soldiers and the girls as potential housewives. In both media, "idea" is a four-letter word. Indeed, the ambiguities and ambivalences which pour in pell-mell upon the television viewer are often closer to the paradoxical or ambiguous qualities of actual life in today's world than the rather mindless and innocuous but totally coherent existence which children are portrayed as having in elementary school textbooks.

What the school does succeed in introducing into the child is a negative charisma, a gratuitous belief in his own intellectual impotence, a distrust of any intellectual powers of his own other than what it takes to cope with problems formulated and assigned to him by others. The lively curiosity that seems to be an essential part of the child's natural impulse is sooner or later beaten or battered out of him by the intransigencies of the educational system.

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The child should be taught to distinguish among different types of situations, and he should be equipped with a battery of methods so that he can adapt the appropriate method to the situation he encounters and recognizes. But the child is not presently equipped to discern such situational differences, nor is he made aware of the differences among modes of response and methods of treatment. There are situations which call for precise and disciplined thinking, but he is not given any indication of what such rigor involves. There are other situations that call for insight and structuring, others which call for questioning and defining, still others which call for creative thinking as to the possibilities of transforming what presently exists into something more satisfactory. He needs many methods; he is given barely one.

The child distrusts not only his own intellectual capacities, but those of his classmates as well. He does not have a set or attitude which would permit him to accept and learn from their experience, because learning is seldom presented to him as a cooperative enterprise; it is seldom shown to him that inquiry is matter of communal activity. He does not realize what discoveries are possible in dialogue and discussion--discovering of another's ideas and of another's person.

Indeed, the child's negative charisma is the inverse of the educational establishment's positive charisma. He can attribute uncanny wisdom and infallible insight to the establishment only by first robbing himself of his belief in his own possession of them. Laing is on very sound ground when he observes that a child(or an adult) often becomes that which we say he is. Children whose belief in their own intelligence is confirmed by others subsequently behave more intelligently.

3. Mind and Thinking in the Curriculum

Over the years, the sciences have marched relentlessly into the classroom: first the natural sciences, then the biological sciences, and most recently the

social sciences. Certainly the physical environment is a fit subject for the child to study. The human body is a fit subject. Why then is the human mind not a fit subject? Children are as much aware of and as keenly interested in their thoughts as they are in their bodily functions. But nowhere is mind in the curriculum. We have begun to teach elementary school children about sex. Why? Because we are afraid that if we do not, they will make "mistakes," i.e., behave in ways that are socially if not individually disadvantageous. But mistakes in thinking can be no less socially disadvantageous. Why then do we not teach the principles of thought in the same way we teach the principles of sex? One cannot help suspecting the reason: mindlessness does not seem to threaten the established order; thoughtfulness might. An irrational social order is threatened far more by rationality than by irrationality.

We teach care of the body--hygiene and physical education. What do we teach children regarding the care of their minds? Indeed, Piaget has somewhere remarked that ethics is the logic of conduct, so logic is the morality of thought. From this point of view, it would seem that if we teach (whether at home or at school) what is "right" and "wrong" about action (i.e., morality), then we should seek to teach what is "right" and "wrong" about thought (i.e., logic).

There are two major questions to be answered here: is logic what is really needed, and if it is, can it be taught?

Much of what goes by the name of "logic", as taught on the college level, is certainly teachable to children. Take that portion of it known as "informal logic". It is almost wholly appropriate to elementary school English courses, and indeed, some of the materials of informal logic have long been parts of the elementary curriculum in some schools. Teaching such material to college students is largely a waste of time, both the student's and the teacher's.

This is not to say that all logic could or should be eliminated from the college curriculum. Certainly symbolic logic should continue to be taught

at that level. Yet, even if symbolic logic could be unpacked, disassembled, and taught in tiny steps, as has been done with the "new math", it is so abstract that it would improve verbal reasoning little more than mathematics courses do it at all.

Another component of most introductory courses in college logic is "scientific method". The materials here are appropriate to a high school level, although some could be introduced much earlier.

This brings us to the question of "formal logic". For most college students, the trouble with formal logic is that it merely makes them conscious of habits of thinking which they adopted long, long ago, and have used more or less faithfully ever since. But either they already have such mental habits, in which case logic is unnecessary for them, or else they lack such habits, in which case the formation of new mental habits is an overwhelmingly formidable task. If the student's thought processes are muddled, the rigor of logic appears to him intolerable. But if his thought processes are swift and individualistic, he is likely to conclude that he has no need at all for the seeming inanities of the syllogism.

Yet, year after year, college philosophy departments agonize over how logic should be taught on the college level. It never seems to occur to the disputants that the question cannot be answered because it rests upon the unreasonable assumption that logic must be taught exclusively on the college level.

Formal logic can, and should, be taught much earlier.

It is not the fault of mathematics or inductive science that educators have tended to employ them as the models of excellence in reasoning. The fault lies wholly with the educators themselves, who have employed techniques that go directly against the grain of childhood thought processes. The child tends to think in terms of wholes rather than isolated details. The organization tion of a painting is a much simple task for him than for an adult; form seems to flow from him quite naturally; only the details give him trouble.

It would seem therefore that if we are to relocate formal logic by placing it in the elementary school curriculum, we should place it at about the fifth grade level, where thinking begins to move from the "concrete" (yet general, global) to the "formal" (yet particular and specific).

Instead of beginning the study of deductive reasoning by isolating logical elements--atomic parts to be fitted together into molecular wholes, we might do better to seek to acquaint the child at first with some of the more general aspects of reasoning. We could try to sketch out the system at first in broad brushstrokes--immediate inference, informal fallacies, categorical and hypothetical syllogisms, etc., while postponing the details of the system until subsequent semesters.

At this point it should be suggested that logic will have value for the fifth-grade child only if it is embedded in a context of ideas, against which it can constantly be applied. What kinds of ideas? Ideas, I would say, such as can be usefully borrowed from the various fields of philosophy: ethics, political and social philosophy, aesthetics, metaphysics, and so on. In short, ideas of what men consider important.

Now if anything is axiomatic about American education, it is that children and philosophy don't mix. Not even high school children. But this is in keeping with Laing's thesis, mentioned earlier. Children are treated as if they were incapable of philosophical deliberation, therefore they behave as if they were incapable of philosophical deliberation. And this is said of children who, with their constant inclination to ask "Why"? behave far more philosophically than most adults! In fact, we discount children's philosophical inquisitiveness because it so often calls into question things we prefer to take for granted. In our anxiety to preserve our beliefs as they are, we classify inquisitiveness with scepticism, and scepticism with outrageous disbelief. "Ah", the child says, "if in the beginning God created the world, then it

wasn't really the beginning after all, was it"?--and we're prepared to throttle him for his unanswerable presumptuousness.

Granted, children probably find abstract philosophical concepts to be almost devoid of significance. They mumble through "with liberty and justice for all", "let freedom ring", and even insist on "one nation invisible", but the words are so much mumbo-jumbo to them. Yet let them feel unfairly treated, and a fierce resentment will flare up. They cannot explain it in terms of "injustices"; they find it very difficult to give reasons for their feeling as they do. But that something they profoundly believe in has been violated, there can be no doubt. And it is my guess that, if they were encouraged to do so, they could discuss among themselves what that something might be, and seek to isolate it, to define it, and to justify it. What is at present lacking is our willingness to create the climate and environment which would provide such encouragement.

It is useless for us to complain that ours is a nation of sheep as long as we do not develop the capacity of independent judgment in children. So long as sheep are what we really want, sheep are what we'll get. (This is one of the few areas in which our hidden desires are fully rewarded). On the other hand, if we begin a course in "Mind" in the fifth grade, what reason would we have for stopping it there? It would make more sense to continue it through high school, at which time the reality-testing theories of epistemology could be brought in to gladden the hearts of adolescents, for whom appearance-reality problems are completely tantalizing. In addition to moving into new areas, the course could move more deeply through old ones. The material is almost inexhaustible.

4. How Can Reasoning be Taught in the Fifth Grade?

But now the crucial question: how is all this to be taught? The didactic method employed in many classrooms would be, in this instance, little

short of a disaster. On the other hand, it would be naive to expect a fifth-grade teacher to be able to assist and guide the children in improvised discussions; such efforts at "discovery through dialogue" are both rare and difficult on the college level, even with highly experienced teachers and highly motivated students, although they can be tremendously impressive when they do succeed.

Improvisational discovery involves a further difficulty, in that the children are quite unclear as to what is expected of them. Some of them suspect that it is to find out what the teacher already knows, without being explicitly told what that is. Some believe it to be an elaborate way of wasting time, because they cannot see precise and concrete results. In short, the children lack a model of discovery-in-practice. But instead of providing such a model, educators have contented themselves with devising stratagems and lures which might provoke the child into a discovery response.

The construction of discovery models is not a simple matter. But it can be done. Using the techniques of children's story-telling, it should be possible to relate idealized instances of cooperative, participatory discovery, not only of the principles of logic, but of ideas in a wide variety of philosophic domains. The stories need be no more "over the heads" of fifth grade students than Plato's Republic is over the heads of college students. All that is necessary is that they should serve as springboards for intellectual discussions, and that these discussions should serve in turn to promote a heightened awareness of and understanding of the world these children inhabit, as well as of their own identities in that world.

But discovery as a method can be only as important as the product that is discovered. If discovery techniques were to be restricted to trivial or banal materials, the result would be to disenchant students as to the possibilities of a technique that turned out always to be so fruitless and unrewarding. Bruner's dictum, that "any subject can be taught to anybody at any age in some

form that is honest", is deserved famous. But the fact that any subject can be taught does not commit us to the belief that any subject is as good for the child as any other, or that we need no discriminations as to the relative importance of different subjects. No doubt it is important that children should play with lenses and discover how convex lenses differ from concave ones; that they should play with magnets and discover the difference between positive and negative poles. But by what criterion do we decide that discovery of these particular distinctions is more important than the discovery of, say, the distinctions between valid and invalid, between true and false, between right and wrong, between good and bad, or between beautiful and ugly?

In the greatest portraits of the discovery of understanding, young men are shown together with old Socrates (or young Socrates with old Paramenides) exploring problems together. Socrates is portrayed as neither beautiful, in any conventional sense, nor again, in any conventional sense, is he shown to be wise, or as a dispenser or purveyor of wisdom. In the great portraits of civilized conversation, ranging from Euripides to Emma and Portrait of a Lady, speech and thought are so wedded that the reader participates in the ebb and flow of ideas simultaneously with the ebb and flow of feeling. Our future educational materials must be devised with such works of art, literature and philosophy as their models--or rather, as their inspiration, for the period which we are coming to in the area of education can no more use models based on the past than the major architects of the 13th or the 20th centuries could use them.

Educators have underestimated the amount of preparation necessary to arouse a child's curiosity. Anyone can pique it. There are countless gimmicks that fascinate children and enchant them. But to get to the deeper levels of their curiosity (their curiosity about what is important), we must do more than merely titillate their interest. We need to construct instructional materials and instruments that contain intellectual shock and surprise. We can hardly expect

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to arouse the real resourcefulness and spontaneity of the child without presenting him with striking ideas of some kind. And at the same time we must be prepared to guide his responsiveness so that he can see its rewards, rather than that he should become disenchanted as a result of the fruitlessness of his own ramblings. There are times that call for structuring discussions and times that call for allowing them to proceed improvisationally; there are times that call for didacticism and times that call for discovery techniques. An effective teacher does not put his trust in any one technique, but relies upon his tact and sensitivity to determine which of his armory of methods he should select and employ on any given occasion.

A curious child is like a coiled spring in that he contains his own energy, his own dynamism, his own way of opening or unfolding. But one must find the proper trigger mechanism to release that energy. This is not just an idle figure of speech. Experimenters have shown how much faster a cat will get out of a box if the release mechanism is connected to a dangling string rather than to a lever, latch, wheel, etc. This is of course because the cat instinctively responds to the string and not to the other stimuli. Similarly, in sexual behavior, what a caress provokes is not merely an isolated response, but a biologically structured process of behavior leading to its own culmination or fulfillment.

In our pedagogical thinking, we have tended to be remarkably narrow. We have puritanically separated instruction from entertainment (much as we have separated work from play--except in the area of art). Instruction is serious, grim and rational. Entertainment is lighthearted and irrational. And then we're amazed to find our children repelled by cognitive activities! What did we expect?

Occasionally we pay lip-service to non-verbal or non-assertive techniques. "Aristotle knows, but Plato shows", we sigh, conveniently forgetting that what Plato demonstrated or (to use Buchler's term) "exhibited" was quite different

from what Aristotle, in his dry fashion was satisfied to assert. For exhibitive techniques are not just entertainment. They are also instruments of disclosure and communication, and they can convey what a standard textbook approach cannot hope to convey.

All of this is an apology for presuming to experiment with the teaching of deduction to 10 and 11 year olds through the medium of a fictional account of the discovery by a group of children of some of the principles of reasoning, and how they subsequently continue their thinking about thinking. Harry Stottlemeier's Discovery is only a beginning (if it is a beginning at all). But if it should develop into something more, even Harry himself might begin to ponder the significance of his own name--minus, of course, its last two syllables.

PART TWO

The Pilot Project whose ostensible aim was to determine the feasibility of teaching reasoning to fifth-grade children was carried out in the Rand School, Montclair, New Jersey during the 1970-71 academic year. The design of the experiment was devised by Milton Bierman, Director of Pupil Services of the Montclair school system.

The Rand School is located in an area populated largely by low-income and lower-middle-income black families. But it had just been paired with the Watchung school, so that two-thirds of its pupils were now drawn from a neighborhood that is primarily white and middle-income. The population of the school was consequently quite heterogeneous.

Bierman established two groups of twenty children each, through randomization. The control group was assigned to a professor from N.Y.U. who was engaged in a social science experiment. Unfortunately his project collapsed after three weeks, and so the remainder of the period of the experiment was devoted to social science instruction in the case of the control group.

The pilot project group was taught by myself, with the assistance of two aides, who were then graduate students in Developmental Psychology: Jerry Jaffe and Jim Harte. We met with the students twice a week (each meeting lasted 40 minutes) for nine weeks. The class was never identified to the students as being "logic" or "philosophy" or any other such term. When necessary, it was referred to as "Dr. Lipman's class." The students asked fairly soon if grades would be given, and they were told that none would be.

Wherever possible during the course, the use of technical terms was avoided, on the assumption that they carry with them, at least to the mind of the child, a negative charisma: they are intimidating, "power" words, the kind used by people in positions of authority. It was this impression we wished to avoid making by avoiding the terms that leave such an impression.

Although I had taught logic and philosophy on a college level since 1952, I'd had no experience with teaching fifth grade students, and my two assistants had had no teaching experience whatsoever. No doubt the students found us a bit odd. I began by reading a chapter of Harry Stottlemeier at a session, but I soon found that they preferred to read for themselves. I was hesitant, because I thought that the class would become impatient with the slow readers. To my surprise, they were patient until the very end with the haltings and stumblings of the slow readers. (The fast readers would often try to read more than their share, but they would have resented my limiting a slow reader to less than his share.) Later on, they were delighted when I let them play roles in those chapters which were designed to permit role-playing. And they loved the video recording session we had--but only when it was introduced suddenly, without prior announcement. On the occasion on which I asked them to prepare for a video taping, they were quite self-conscious and inhibited.

I would like to cite my notes which I wrote at the end of the first week of the project:

Friday, October 16, 1970:

Today was the second day for Harry Stottlemeier, and we've already gone through two chapters. But I think we'll slow down once we hit the discussion materials in Chapter 3.

On Wednesday, when we first saw the students, we were more apprehensive than ever: they looked so small! I read the first chapter to them with virtually no explanation of what we were doing. They listened very quietly, turning the pages in unison while I read. Then I asked what Harry had discovered. I expected some halting, fumbling replies. In fact, we already had prepared some very elementary exercises (e.g., different ways of filling in blanks: "All_____ are fish," and "All kittens are _____," etc.).

What we didn't expect was that the very first answer was lucid and absolutely complete: that Harry had discovered that if you take a sentence beginning with all, and turn it around, then if it was true at first, it will be false. But if you take a sentence beginning with no, and turn it around, it'll still be true. We were astonished! The remainder of the class did as well. We went down the rows and asked them to illustrate the rule, and they had no difficulty at all. (We found today that some of them had difficulty writing out the rule, but they have no problem applying it.) This is all the more interesting when we recall that these kids are from levels C and D-average and below average.

Moreover, they brought out certain deficiencies in the chapter: the need to turn adjectival predicates into noun phrases (e.g., to turn "All kittens are frisky" into "All kittens are frisky things," so that it can be reversed without awkwardness)

Also, it became clear that they wanted to know about sentences that began with "No" and were false--did they stay false when reversed? I was so surprised that they'd caught on to something omitted from the chapter that I didn't at first have the courage to answer. But later I told them that such a sentence, when reversed, could be either true or false. (I originally omitted this, I suppose, because it destroys the easy symmetry of the rule--but that was no justification.)

Today's story went well, except that many or most of the children hadn't yet studied fractions, so they didn't know about lowest common denominators. This portion of Chapter 2 will have to be changed.

One thing we noted about both days was that the kids really relish having some tangible results to write down in their notebooks. I had thought originally that the logical rules would be what they would resist, and would have to be coaxed into accepting by the bonus of pleasure from the stories. But that doesn't seem to be how it works. They seem to look upon the rules as the tangible, visible profits of the enterprise, the rewards they can take home and show. The pleasure they get from the stories themselves is somehow of a different order.

We administered three quizzes in reasoning during the nine-week course. When the experiment was concluded, Jerry, Jim and I went our separate ways, but I received a computer printout from Jerry indicating that the results of one of the tests showed a difference between the two groups of .28, which he did not consider significant. Somehow I interpreted this to be the result of the post-test rather than of the final quiz. I suspect that I was resigned to believing that the experiment might produce important changes in the children's attitudes, but since these probably could not be demonstrated, I didn't really expect significant improvements in achievement. Call it a defeatist attitude, but the fact is that I accepted the presumed result with resignation.

I didn't learn until the summer of 1973 what the actual results of the post-test had been. This is a quotation from Jerry's report:

> Both groups (the pilot study group and the control group) were initially tested for their knowledge of logic and logical reasoning through the use of four specific test parts of the California Test of Mental Maturity (1963 Revision Long Form)...No significant differences occurred between the two groups prior to the start of the program although both groups demonstrated above average scores in the results.
>
> At the end of nine weeks, both groups were again tested for their knowledge of logic and logical reasoning. The same four tests of the California Test of Mental Maturity were used except that the items were extracted from the Short Form (1963 Revision) of the test.
>
> The pilot study group showed significant gains over the control group in the area of logic and logical reasoning (p. .01). The computed mental ages (as related to logic and logical reasoning ability of the pilot study group and the control group were 167 months (13 years 11 months) and 140 months (11 years and 8 months) respectively. The control group showed no significant advance over their initial test scores.

It took me several days to digest this information. How significant was the reported difference of .01? Bierman informed me that it was an unusually high degree of significance. This became fairly evident when one considered the increase of 27 months in mental age of the pilot study group at the end of the 9-week program.

I could hardly believe we'd made such an impact on the kids in the study. After all, we'd not made much of a fuss about teaching logic: there was no homework, no

grades, no written classwork--it was all discussion, and the discussions usually got far away from the subject of deductive inference. On the other hand, we had taken the kids seriously and they seemed to take us in the same way. We promised them nothing, and we felt they were satisfied that what they were doing was meaningful. After all, children don't like being told, when they ask what something means, or why they have to do something, "Wait, you'll see." To them, that's so much pie in the sky. They want meaning now. They want meaning to be intrinsic, not extrinsic. So maybe we did something right!

I called Jerry. He told me that the results were quite as he had set them down in his report. Unfortunately, he no longer had the data, which meant that our findings couldn't be substantiated.

This was getting to be a roller-coaster ride of successive elations and disappointments. I discussed the matter with Bierman, so as to put things in perspective. All right, so the principles of logic (from immediate inference on through the categorical and hypothetical syllogisms) could be taught to children. So what? The important thing was, what effect would this have on their general achievement levels? And would such an effect be a lasting one? I suggested to Bierman that we compare the Iowa scores of the two groups for the years 1971 and 1973. The crucial scores would be the reading scores. It seemed very improbable, however, that a nine-week course in logic and philosophy taken late in 1970 would influence the reading scores of a group of children in 1973.

But when I glanced over the raw scores, I was convinced we were on to something. Bierman's calculations confirmed my suspicion: the difference was indeed significant--in fact, it was the identical high level of significance, .01, which Jerry had discovered in his post-test.

This is Bierman's report:

A Pilot Study in the Teaching of Logic
Research Conclusions

by

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1. Hypothesis

Fifth grade students who are taught aspects of logic will score significantly higher on a test designed to measure proficiency in the use of logic than will fifth grade students who are not so taught.

The null hypothesis is that students who are taught logic will score equal to or lower on the test than students not so taught.

In statistical terms, this is a type two test which can be stated in the following way:

$H_o: M_1 \leq M_2$ with $H_1: M_1 > M_2$*

II. Operational Definitions

A previous researcher used four sub-tests (inferences, opposites, analogies and similarities) of the California Test of Mental Maturity (1963 Revised Long Form) to determine that the two treatment groups which were randomly chosen were in fact equivalent. Extracted items from the same sub-tests of the Short Form of the California Test of Mental Maturity (1963 Revision) were used as a post test.

Unfortunately, the previous researcher did not report and apparently cannot produce the data on the basis of which he came to certain conclusions.

The present researcher was left with the problem of either retesting the students using the California Test of Mental Maturity almost three years after the experiment or of determining a different test for measuring the two groups. The school district in which the experiment was conducted tested all of its students in grades three through eight with the Iowa Test of Basic Skills. An examination of the test revealed that the reading sub-test, though not as adequate as the California Test of Mental Maturity, might be an adequate measure particularly beginning with the grade seven test. The present researcher decided to use grade equivalency scores of the students on the reading sub-test of the Iowa Test of Basic Skills (Form Six) given in May, 1973 when the students were seventh graders. Implicit in this decision were certain value judgments, namely, that the grade seven reading test was a more adequate instrument for the purposes of this research than were the fifth and sixth grade reading tests, that the need for the more sensitive instrument was a more

* cf. Edwards, Allen L. Experimental Design in Psychological Research, Third Edition, 1968. Holt, Rinehart & Winston, Inc., New York. Pages 88-91

important consideration than the two and a half years separating the testing of the students for the experiment, and that any significant results still evident after two and a half years would strengthen the results of this pilot study.

III. Treatments

The experimental treatment was designed and implemented by Dr. Matthew Lipman. He has described his method and materials adequately elsewhere. Suffice it to say here that the treatment consisted of 18 sessions, twice a week, for nine weeks in the Fall of 1970.

The control treatment was designed to be an experiment in the use of games in the teaching of social studies. After six sessions this approach was abandoned; the consultant left; and the students received formal instruction in social studies for the following twelve sessions from their regular teachers.

The control treatment as originally conceived was an attempt to define a second treatment that could be as appealing to the students as the experimental treatment. This attempt was made to minimize the halo effect.

All sessions were about 40 minutes in length.

IV. Randomization

At the time the original research was designed, the present researcher because of his position in the school system involved, randomly assigned the students in two fifth grade classes to the two treatments having first blocked them on their functional reading level as demonstrated in their reading class. The method of randomization used was a table of random numbers. 19 students were assigned to each treatment with one extra student being assigned to the experimental group.

The previous researcher confirmed the equivalency of the two groups by the results of his administration of the California Test of Mental Maturity as a pre-test.

The question is whether or not these two groups were still equivalent two and a half years later. The theory of randomization argues that they would be. However, a check of the students indicated that all the students originally assigned to the experimental group took the Iowa Test of Basic Skills in May of 1973 whereas three students from the control group had moved away and two more did not take the test in May of 1973. According to the theory of randomization an equivalent number from both groups should have moved and not taken the post test. No students missing in the experimental group and five missing in the control group suggests that the groups if random once upon a time were no longer random in May, 1973.

To try to determine whether it was reasonable to assume that the two groups were still random, a second sub-test on the Iowa Test of Basic Skills was examined. It was determined by Dr. Lipman and this researcher that there was no reason to believe that the results of the experiment on the control treatment should affect students' ability to spell. Therefore, if the groups were random, they should have equivalent scores on the spelling sub-test of the Iowa Test of Basic Skills.

An examination of the data on Chart 11 indicates that the two groups were essentially equivalent on the test. The researcher thereby drew the conclusion that the two groups were still equivalent when the block containing the missing students were eliminated. The research design was still valid.

V. Statistical Designs & Results

The statistical model used was that of a randomized block design utilizing a test rather than analysis of variance. The data and the results are included as Chart 1.

The computed value of t in the comparison of the two treatment mean is 2.8. The tabled value of t with a level of significance of .01, with a one-sided test, and with thirteen degrees of freedom is 2.650.

Because the computed value of t is higher than the tabled value, the null hypothesis can be rejected. This suggests that there is only one chance out of a hundred that the experimental group did not score significantly higher on the reading subtest of the Iowa Test of Basic Skills than the central group.

The conclusion to be drawn is that the experiment conducted positively affected the reading scores of the students two and a half years later.

This result confirms that found by the original researcher. His statement of result follows:

> The pilot study group showed significant gains over the control group in the area of logic and logical reasoning (p .01) The computed mental ages (as related to logic and logical reasoning ability) of the pilot study group and the control group were 167 months (13 years 11 months) and 140 months (11 years 8 months) respectively. The control group showed no significant advance over their initial test scores.*

VI. Discussion

These results strongly suggest:

1) that the students in the experimental group learned something that was very useful to them

2) that this was accomplished in a relatively short period of time

3) that the effects probably still distinguish these students from their control counterparts

4) that the teaching of logic affected their ability to read which is a subject of vital concern in education

5) that the experiment is worthy of replication to confirm internal validity and to build external validity.

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* Jaffe, Jerry. "Misapplication of Piaget's Developmental Model" Unpublished and undated class paper. Developmental Psychology. Montclair State College. Page

Chart I

Reading

Randomized Block Design

	Exp.			Control				
Block	X	x	x^2	Y	y	y^2	D	D^2
1	111	25	625	[illegible]	9	81	-13	169
2	114	28	784	100	21	441	-14	196
3	102	16	256	100	21	441	+ 2	4
4	94	8	64	92	13	169	+ 2	4
5	95	9	81	93	14	196	+ 2	4
6	98	12	144	95	16	256	+ 3	9
7	87	1	1	89	10	100	- 2	4
8	81	-5	25	88	9	81	- 7	49
9	77	-9	81	67	-12	144	+10	100
10	78	-8	64	76	- 3	9	+ 2	4
11	70	-16	256	72	- 7	49	- 2	4
12	65	-21	441	50	-29	841	+15	225
13	67	-19	361	50	-29	841	+17	289
14	65	-21	441	39	-40	1600	+26	676
Σ	1204		3624	1109		5249	95	1737
M	86			79				
σ^2	259			375				
σ	16.1			19.4				

$\Sigma(D - \bar{D})^2 = D^2 - \frac{(D)^2}{n} = 1092.4$

$\sigma_{M_1 - M_2} = \sqrt{\frac{\Sigma(D - \bar{D})^2}{n(n-1)}} = 2.5$

$t = \frac{M_1 - M_2}{\sigma_{M_1 - M_2}} = 2.8$

with α = .01, a one-side tested df = 13, the tabled t = 2.650
therefore the null hypothesis $M_1 \leq M_2$ is rejected.

00027

Chart II

Spelling

Randomized Block Design

	Exp.			Control				
Block	X	x	x^2	Y	y	y^2	D	D^2
1	112			116				
2	103			88				
3	96			94				
4	99			88				
5	93			86				
6	93			83				
7	86			85				
8	90			80				
9	76			65				
10	65			80				
11	72			63				
12	51			60				
13	44			63				
14	25			57				
	1105			1108				
	79			79				

By inspection of the treatment mean, the null hypothesis, is not rejected.

$M_1 \leq M_2$

I am now convinced that philosophy can and should be a part of the entire length of a child's education. In a sense this is a kind of tautology, because it is abundantly clear that children hunger for meaning, and get turned off to education when it ceases to be meaningful to them. And philosophical discussions are precisely the proper medium for putting things in perspective, getting a sense of proportion, and achieving some kind of insight into the direction of one's life. So to want meaning and to require a philosophical dimension to one's education amount to pretty much the same thing. As Kant says, who wills the end, wills the means. If we really want children to find their educations meaningful, we'll devise a suitable philosophical component. And if we don't devise such a component, it's because we really don't want them to wonder what it's all about.